Soil Conservation

October 1977

U.S. Department of Agriculture

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From the Administrator

More Women Are Conservationists

This month is the 10th anniversary of the Federal Women's Program and we can report that the number of women in professional positions in the Soil Conservation Service is definitely increasing.

In 1975, there were 191 women in full-time professional and administrative positions in the Service. In 1976, this number rose to 242. By the end of 1977, it will be higher still. In addition, more student trainees and cooperative students are women than ever before in our history.

SCS, of course, has never been without its valuable women employees. The majority of them, then as now, were in secretarial and clerical positions. In past years, however, several professional career ladders were not generally accessible to women. This is not the case today.

One important breakthrough for women in SCS jobs occurred about 2 years ago, during International Women's Year, when Roberta J. Stevenson became the first woman district conservationist and line officer in SCS history. Since then, four more women have been promoted to district conservationist jobs.

What is happening in SCS, of course, is happening throughout business, industry, and government. Barriers to women's employment and advancement generally are coming down in all kinds of fields that used to be the exclusive province of men.

The old excuse that certain jobs are "too rough and strenuous" for women is deader than a doornail, hopefully for good. Women in many cultures have traditionally done *all* the heavy work; women in agriculture, even in America, worked alongside their husbands in the field for many hours, performing work that would quickly exhaust most male American office workers today.

Also without validity is the excuse that "men don't accept advice from women." One is tempted to say that women in their role as wives have been successfully advising men for countless centuries. More to the point, however, is the fact that farmers seeking conservation assistance are only too glad to receive it from anybody—provided it is competent, knowledgeable help. In SCS, as in other enterprises, it is competence that counts, not sex or race or national background.

We are not overlooking the women who are already employees of SCS in nonprofessional positions. SCS is committed to increasing and improving their educational and training opportunities through such vehicles as the Federal Women's Program and the Upward Mobility Program.

It has been stated repeatedly in the Service that there is not a job in the organization that cannot be filled by a qualified woman. We mean it.

Mel Davis

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Cover:
With drip irrigation systems, avocado growers can plant their orchards on land too steep for traditional cultivation. See pages 8 through 14. (Photo, Donald C. Schuhart.)

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SCS women in professional positions include Sherrie K. Barham (at right), a hydraulic engineer in the Michigan State Office; E. Selden Cowan (below, top), soil survey party leader, St. Joseph County, Mich.; and Donna L. Storch (below, bottom), soil conservationist in Yakima, Wash.

An increasing number of professional women are finding career positions in the Soil Conservation Service.

Update: Women in SCS

Patricia O. MacPherson, chief of the Soil Survey Editorial Staff, Hyattsville, Md., studies a soil profile with a soil scientist from Maryland.

Peg S. Whiteside is a civil engineer working out of the Superior, Wis., field office.

Joan K. Love is the first woman administrative officer in SCS.

At last count, there were more than 1,600 women in permanent, full-time jobs in SCS, and 281 of them occupied professional, administrative, or information positions. This is over 25 percent more women than held such jobs a year earlier. An additional 65 women were employed as student trainees and 29 were participating in the cooperative education program.

It has been 2 years since Roberta J. Stevenson became the Service's first woman district conservationist, working with the Wellton-Mohawk Valley Natural Resource Conservation District in Arizona. Since that time, four other women have been appointed to district conservationist jobs—Sheila Miller in Pennsylvania, Gail Moffitt in California, Carol Anderson in Idaho, and Miriam Bailey in North Carolina.

Another woman, E. Selden Cowan, was named soil survey party leader last June, heading a team in St. Joseph County, Mich. Her promotion followed 7 years of experience as a soil conservationist and soil scientist. Also this year, Joan K. Love became the first woman administrative officer in SCS, in the West Technical Service Center (TSC), Portland, Oreg.

In a dozen State offices, women now serve as public information officers or specialists, and they work as information assistants in two more. Three women are upward mobility trainees on TSC field information staffs.

In the Washington office, there are 19 women in professional editing and writing positions. They include Patricia MacPherson, who heads the soil survey editorial staff; Charlotte Colton,

At right, Sheila M. Miller, district conservationist, Clarks Summit, Pa., discusses conservation plan with a cooperator. Below, Gail T. Moffitt is district conservationist, Colusa, Calif.

Miriam G. Bailey was a soil conservationist before she became district conservationist in Sanford, N.C., in April 1977.

head of the general publications unit; Shirley Fields, who handles radio and television news; and Judith Ladd, editor of *Soil Conservation* magazine.

Also in key jobs in Washington are Sally Schauman, landscape architect; Ida Cuthbertson, community planner; Kay Mergen, educational relations specialist; Eleanor Wilson, personnel staffing specialist; Shirley Elliott, program analyst; and Ruby Gill, computer specialist.

Servicewide, women today are working as agricultural and civil engineers, range conservationists, and soil scientists. Some 56 are soil conservationists. In nonprofessional technical positions, 53 women have cartographic jobs, 5 are engineering draftsmen, 6 are biological technicians, and 1 is a construction inspector.

The increased number of women in SCS is evidence of women's growing commitment to jobs outside the home. In 1950, there were only 18 million women working or seeking work. In 1976, there were more than 38 million women over age 16 in the civilian labor force—more than 40 percent of the total.

According to projections, by 1990, more than 48 million women will be working, making up nearly half the work force. Many more will be in jobs related to agriculture; some 28 percent of the 97,727 students enrolled in agricultural schools during 1976–77 were women.

Another factor in the brighter job picture for women is the growing influence of the Federal Women's Program (FWP). Created by Presidential Execu-

Top, before becoming the district conservationist in Meridian, Idaho, Carol A. Anderson worked as a resource conservationist.

Bottom, Roberta J. Stevenson, Wellton, Ariz., is the first woman district conservationist.

On the Lighter Side

by Carol A. Anderson

It is in the field, as every Soil Conservation Service employee knows, where all the important "action" takes place.

The job of district conservationist (DC), besides being very interesting and enjoyable, also has its share of humorous, memorable moments.

I had been the DC in Ada County, Idaho, for only a short time when I went to the State prison farm for a meeting on a revision of the farm's conservation plan. As I prepared to leave the compound afterwards, the gate wouldn't open. I nearly tore it off the hinges in my panic before the guard in the tower pressed a button to let me out.

A 65-year-old farmer told me to be sure and tell his wife I'm from SCS when I call so she won't think I'm his girl friend.

The State information specialist accompanied me to a farm for a session on conservation planning. The landowner's dog attacked her three times before the owner dragged him away and locked him up.

A gander belonging to the chairman of the soil conservation district chased me from the chairman's house to the car. Then he fell in love with my station wagon and wouldn't stop nuzzling it so I could leave.

The secretary at one of the schools I'm working with refers to me as the "Dirt Lady." She has a hard time remembering I'm from SCS.

Being a DC has its obviously challenging, serious side. But if you keep your sense of humor, it's a job that will reward you with some funny experiences, when and where you least expect them.

Ms. Anderson became district conservationist in Meridian, Idaho, in January 1977.

tive Order a decade ago, the program is designed to prohibit discrimination in federal employment based on sex. FWP gained greater clout with the passage of the Equal Employment Act of 1972, which brought Federal agencies under the equal employment opportunity provisions of the Civil Rights Act of 1964 for the first time.

The first SCS FWP coordinator was formally appointed in August 1973. There now is an FWP coordinator in each SCS State office and each TSC who spends varying amounts of time on FWP activities. Coordinators work with administrators and women employees developing equal employment opportunity and upward mobility plans, counseling employees, and promoting self-development and continuing education.

Renee A. Sisson, FWP coordinator for SCS, says that what women want is simply equality of job opportunity. To supervisors of women in the Service, she advises: "Expect of women what you would expect of men in productivity, responsibility, and participation. To expect less is patronizing; to expect more is unfair."

by Anne Schuhart

Strawberry farmer Jack Tabata says the quality, color, and size of his berries are better with drip irrigation.

Drip Irrigation Aids Great Plains Windbreaks

by Jerry Schwien

Drip irrigation is making automatic tree-watering practical for the first time in the Great Plains. "It's a break from hose and pail," says Gene Anderson, Soil Conservation Service woodland conservationist in Denver, Colo.

Drip systems were cost shared on windbreaks for the first time this spring. Cost share is 80 percent and is available to farmers under both the Great Plains Conservation Program (GPCP) and the Agricultural Conservation Program (ACP).

"The survival rate has always been low on windbreaks in the semiarid Plains," said Anderson. "Our objective with drip irrigation is to provide additional water to help establish trees in their early years."

Keith Bruce, a farmer in Fort Morgan, Colo., installed one of the first drip systems. His windbreak of 300 trees is watered by a plastic pipe and 300 emitters, which drip the required amount of water directly at the base of each tree. His pipeline is completely above ground, snaking down the rows of trees from a nearby shed which houses the well, pump, and filtration system.

The efficient use of water is the most outstanding feature of drip irrigation. Drip systems also minimize losses to evaporation and seepage, save time, lower the mortality rate, and speed early growth.

Anderson says several different types of emitters can be used on windbreaks, from the very basic to the complicated. The emitters used on Bruce's 300 trees were 48 cents each. His total system cost $420.

The program is popular with farmers. Some 67 drip systems were installed in Colorado this spring.

Cost sharing is available for drilling and casing small diameter wells, developing springs or seeps, water storage, small diameter pipelines, and inexpensive drip or similar type irrigation systems within the windbreak.

Mr. Schwien is public information officer, SCS, Denver, Colo.

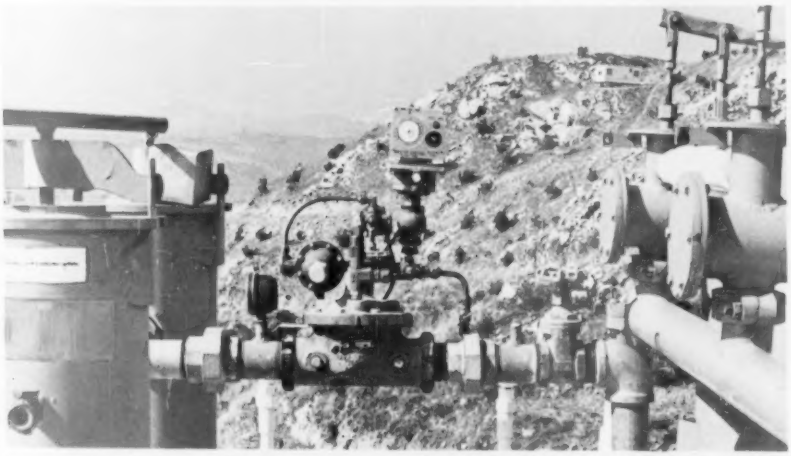
Irrigation Drop by Drop

Drip irrigation conserves precious water, improves crop quality, and brings nonarable land into production.

Although water dripping slowly—drop by drop—keeps most people awake in the middle of the night, it's helping a growing number of farmers around the world rest more easily.

Water dripping slowly, much as it falls from a leaky faucet, is the principle behind a new type of irrigation. Drip systems apply water frequently at the base of plants. Properly managed drip systems can use less water than other irrigation systems and eliminate erosion. Enthusiasts claim that they cut costs of fertilizer and labor while

Types of emitters include pressure compensating (right), spot spitter (below left), and spaghetti (below right).



At the head or control station, water is measured, filtered, and treated with fertilizer. An automatic timer (center) run by a standard flashlight battery turns the water on and off to irrigate an avocado orchard near Fallbrook, Calif.

Gages in Chuck Kryder's orchards measure water pressure as a check for leaks in the system.

boosting crop production and quality.

Drip systems consist of emitters, lateral lines, main lines, and a "head," or control station. Emitters control the flow of water from the lateral line to the soil at the base of a plant, generally at a rate of 1 to 4 gallons per hour. They come in more than a hundred styles. Some are simply perforations in lateral tubing; others, which look like pillboxes or small garden hose nozzles, are more complex and adjust water pressure. The number of emitters used ranges from less than one per plant for row crops to eight or more for large trees.

Generally, one lateral line is laid per tree row and one for each crop row or pair of rows. Main lines, usually buried, carry water from the head to the laterals.

Emitters and lateral and main lines are usually plastic. Some emitters and lateral lines are used only one season; others are designed to last much longer. Main lines are usually permanent.

At the head, water is measured, filtered or screened, and treated with fertilizer. Chemicals are injected to prevent clogging of emitters. Water pressure is regulated as is timing of applications, generally 1 to 16 hours every 1 to 3 days.

Variations of drip, or trickle, irrigation include bubbler and spot spitter systems, but all incorporate the same principle of water applied slowly and frequently at the base of a plant.

Drip irrigation was developed largely in Israel and brought to southern California about 1970. By 1975, some 60,000 acres of California row and tree crops were drip irrigated, and by 1980, an estimated 100,000 acres will be under drip systems. Thousands more acres are drip irrigated commercially or experimentally in Arizona, Florida, Hawaii, Texas, and more than 35 other States.

At the end of 1975, more than 270,000 acres in 70 different crops were drip irrigated worldwide. By 1980, more than 850,000 acres of the world's crops are expected to be under drip systems, according to the University of California Cooperative Extension Service.

Conserves Water

Water conservation is one of the biggest advantages of drip irrigation, especially on young crops whose root systems are not fully developed. Drip systems apply water only within reach of plant roots instead of wasting water between plant rows.

"Drip systems saved 4,000 acre-feet of water on 4,500 acres of row crops in San Diego County last year," said Bernarr J. Hall, Cooperative Extension Service farm advisor for the county. With water costing $80 to $150 per acre-foot, the water savings translate into money savings of about a half-million dollars.

Hall estimates that in California drip systems use 50 percent less water than furrow systems on sandy soils and 20 to 30 percent less on finer textured soils.

An Agricultural Research Service (ARS) study conducted by Kenneth Davis and Sterling Davis at Riverside, Calif., confirms Hall's figures.

"We found that corn required 14 acre-inches of water under drip irrigation and 31 acre-inches under furrow," Kenneth Davis said. "Of course, the amount of water saved depends on how well the systems are managed. Drip systems are only 10 percent more efficient than well-managed sprinklers."

"The water you save through drip irrigation is what you would waste with another type of system," explained Chuck Kryder, a director of the Navelencia Resource Conservation District in Fresno County. Kryder drip irrigates fruit and nut orchards. "Drip systems save a lot of water on young trees. Although they save less on mature trees, they still use less water than other systems.

"Drip irrigation is the ultimate in water conservation," he added. "It should really help farmers during a drought."

Mike Mellano and Battista Castellano of San Luis Rey use drip irrigation on 70 acres of Shasta daisies, Gypsophilia, asters, candytuft, asparagus fern, and eucalyptus for floral displays. The rolling terrain made their furrow system difficult to manage, so they switched to drip.

"We use about 30 to 40 percent less water with drip than with furrow irrigation," said Mellano. "And since we use a constant feed system, when we use 30 percent less water, we're also using 30 percent less fertilizer."

"Drip systems saved 4,000 acre-feet of water on 4,500 acres of row crops in San Diego County last year."

Like many drip irrigators, Mellano uses tensiometers to measure soil moisture. But, he said, "A good farmer always passes his shadow over the plant. That's an old Italian saying I learned from my father. It means that there's no substitute for going out into the field and looking to make sure the crop is getting the right amount of water."

In addition to conserving water, drip systems help protect the quality of water supplies. Because drip systems are so efficient, there is little or no salty excess irrigation water to be pumped out of the ground and discharged back into rivers. The Soil Conservation Service, for example, is helping citrus farmers in the Wellton-Mohawk area of Arizona plan and install drip systems as part of the Colorado River Basin Salinity Control Program.

Saves Soil

In some parts of the country, arable land is fast becoming a limited resource. As industries and housing developments move away from inner cities to the outer edges of suburbs, they are taking over more and more prime farmland—causing the cost of the land and property taxes to skyrocket.

But in San Diego County, drip irrigation has enabled agriculture to "take to the hills." Growers are planting avocado orchards on rocky slopes of 60 to 70 percent, where furrow irrigation is out of the question and sprinkler systems are impractical.

"With a spitter system, we are developing 200 acres of avocados on rough terrain that before now had very little value. Without drip irrigation, it could never be used for anything but grazing from February to May, and even then it would require 10 to 15 acres or more per cow," said Homer Williams, manager of orchards near Escondido.

"We develop these rugged hillsides with very little erosion by doing some of the things SCS has helped us with—laying out roads on the contour, terracing, using straw as mulch, and never disturbing the ground more than we absolutely have to."

Once the avocado trees are planted and the irrigation system is in place, the ground is not disturbed. Properly functioning drip systems produce no runoff to erode the soil.

Drip systems, in fact, are included in land treatment plans for the area above Dixon Dam, one of the flood control structures in Escondido's small watershed project. They help prevent sedimentation that would fill in the reservoir.

Produces Better Crops

Along with conserving soil and water, farmers credit drip systems with producing higher yields and better quality crops.

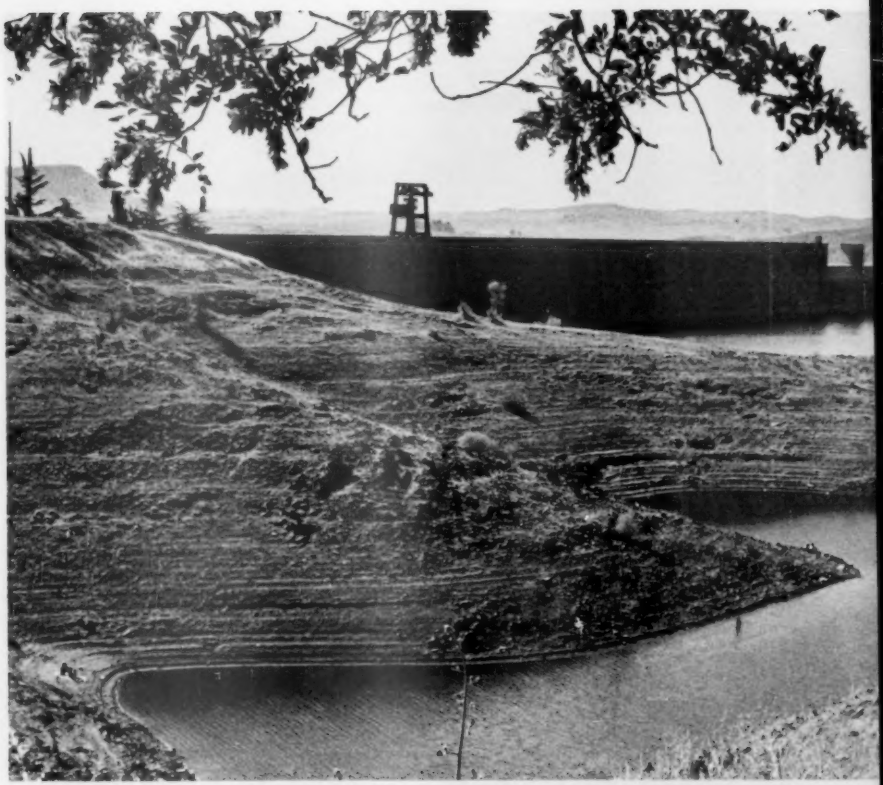
"We experienced a 20 percent increase in production in 1971 when we converted half our acreage from furrow to drip," said Jack Tabata, a strawberry farmer near Oceanside.

Tabata then converted entirely to drip irrigation, which allowed him to widen his strawberry beds to 60 inches, increasing the number of plants per acre. Last year he harvested 4,750 trays of strawberries per acre, almost twice the number he had produced with furrow irrigation.

Drip irrigation also expanded Tabata's growing season by providing a steady, optimum supply of water in-

By 1976, more than 270,000 acres in 70 different crops were drip irrigated worldwide. By 1980, more than 850,000 acres are expected to be under drip systems.

Last spring, Fresno County's Friant Dam and Millerton Lake held only one-fourth of the normal irrigation water supply. One of the biggest advantages of drip irrigation is water conservation.



Grapes for raisins (top) and kiwi fruit are grown under drip irrigation in California.

Layflat main tubing and buried lateral lines form part of the drip system irrigating tomato plants.

Citrus growers generally agree that the steady supply of water provided through drip systems produces better quality fruit by eliminating stress.

"Drip irrigation is the ultimate in water conservation. It should really help farmers during a drought."

stead of subjecting plants to wet and dry extremes as do furrow systems.

"We go to market 10 days earlier, and we pick strawberries 30 to 40 days longer than before," he said.

"The quality, color, and size of our berries are better with drip irrigation even though we have cut back fertilizer by 30 percent," Tabata added. He now sells more of his crop for the fresh berry market, which brings a higher price than berries sold for processing into jam and other products.

Citrus growers generally agree that the steady supply of water provided through drip systems produces better quality fruit by eliminating stress. Some growers also report that their trees are bearing heavy crops every year instead of every other year, which is normal for citrus.

In the ARS study, however, the drip system did not increase yields. "In our study on corn grown under drip and furrow irrigation, the yields are the same; drip irrigation is just a more efficient use of water," Kenneth Davis explained.

"If you do a good job of managing the irrigation systems, there is no difference in yields unless, of course, you increase the plant population," he continued. "The plant doesn't care how it gets water."

Cuts Labor

Jack Tabata said that his drip system also saves on labor costs since the water merely needs to be regulated, not tended.

"I'm budgeting the same amount of money for labor as I did 3 years ago even though wages have increased by 30 percent.

"Drip provides advantages in management," he said. "For example, on a cloudy day when it might rain, you irrigate furrows. If it does rain, you have to run out with shovels to open the furrow ends so the plants don't flood. With a drip system, you can turn it on just enough to sustain the plants but not flood them if it does rain."

A drip system designed by Allan Chaikin for an avocado orchard near Fallbrook requires even less labor. The system includes sand filters, screen filters, and fertilizer tank; buried main and lateral lines; emitters; and risers to elevate emitters. An automatic timer run by a standard flashlight battery controls the daily irrigation, and the system automatically switches to a 6-minute backflush cycle when the screen filters get dirty.

"One man comes in 1 day a week," said Chaikin. "He dumps two sacks of fertilizer in the tank and walks around to check for leaks. He checks gages at each 20-foot terrace level to make sure the water pressure and distribution are even. It takes about an hour."

Drip systems also provide other benefits. Because much of the soil surface between rows is never wetted, fewer weeds grow. The relatively dry and firm footing also makes field operations, such as harvesting, easier.

High Cost

Availability of drip systems is limited in some areas, and the drought has increased the already high demand for systems from an industry that started in this country only a few years ago. Because of this limited availability and the high cost of the systems, not all farmers who want to convert to drip systems will be able to right away.

"Because of the cost," said Bernarr Hall, "a grower has to get better yields or better quality, save on water and fertilizer costs, or cut labor to make drip irrigation economical."

Chuck Kryder's drip system cost $300 per acre to design and install. He drip irrigates 3,000 young peach, plum, and almond trees on 30 acres. His system includes a 10 horsepower turbine to pump well water to the surface, a 5 horsepower booster to pump the water through a screen mesh filter, a main line, lateral lines, and one emitter per tree. As the trees grow, Kryder will add three more emitters per tree at a cost of 50 cents per emitter. Other systems cost from $200 to $1,000 per acre.

Because of the economics, drip irrigation is spreading fastest on high-

value crops, such as avocados—which gross more than $1,200 a season per producing acre—and on other crops that require a high capital investment and much labor. Installing a drip system on such crops is a lower percentage of the total investment than on other crops, according to Jan van Schilfgaarde, director of the ARS Salinity Laboratory at Riverside.

Of course, not every farmer wants to convert to drip irrigation. For example, a farmer with a well-managed furrow or border irrigation system on level land may find the water savings do not offset the extra cost for energy and maintenance.

Although new systems are designed to drip irrigate additional types of crops every year, some crops are not readily adaptable. For instance, drip systems are not likely to replace giant center-pivot systems on the wheat and corn fields of the Great Plains.

In addition, some soils do not absorb moisture fast enough, so water runs off or ponds. Generally, drip systems work best on sandy soils and least efficiently on fine-textured soils.

In San Diego County, drip irrigation has enabled growers to plant avocado orchards on rocky slopes that previously had little value.

"Under furrow irrigation, capillary action pushed salt to the top of the beds . . . Our drip system has produced no salt buildup, and we are growing more, better quality flowers."

Management Problems

Many farmers who do convert to drip systems find that because the openings are so small, emitters become clogged easily. "Clogging is the biggest problem with drip systems," said van Schilfgaarde. "It changes the discharge rate and moisture distribution.

"There are three causes of clogging: mechanical, chemical, and biological. The type of clogging varies drastically from water source to water source," he explained. "For example, in the Wellton-Mohawk area of Arizona, algae plug emitters. In San Diego County, however, the water is chlorinated so there are no algae."

"Good filters are the first thing you need in a drip system," Bernarr Hall said. "A sand filter screens out 99 percent of the particles that would cause mechanical clogging, and then a screen mesh filter catches all the others except those smaller than the emitter openings." The filters themselves also must be kept clean.

Chemicals combining in the irrigation water also can cause clogging. Phosphate fertilizer, for instance, can react with calcium in the water and form granules that will clog fine mesh filters and openings.

"Remember to inject fertilizer between the sand and the screen mesh filters," Hall advised. Minute amounts of dilute sulfuric acid added to irrigation water also help prevent chemical plugging by controlling the pH.

Some farmers are concerned about accumulations of salt around the perimeter of the area wetted by emitters. Van Schilfgaarde, however, explained that since the salt is crystallized, it should cause no problem. Only when the salt is in solution will it damage plants. The soil should not be allowed to dry between irrigations, as this could cause the movement of soil water to reverse and draw salt from the perimeter back toward the emitter. Also, during rains, irrigation should continue long enough to make sure the salts are leached below the root zone.

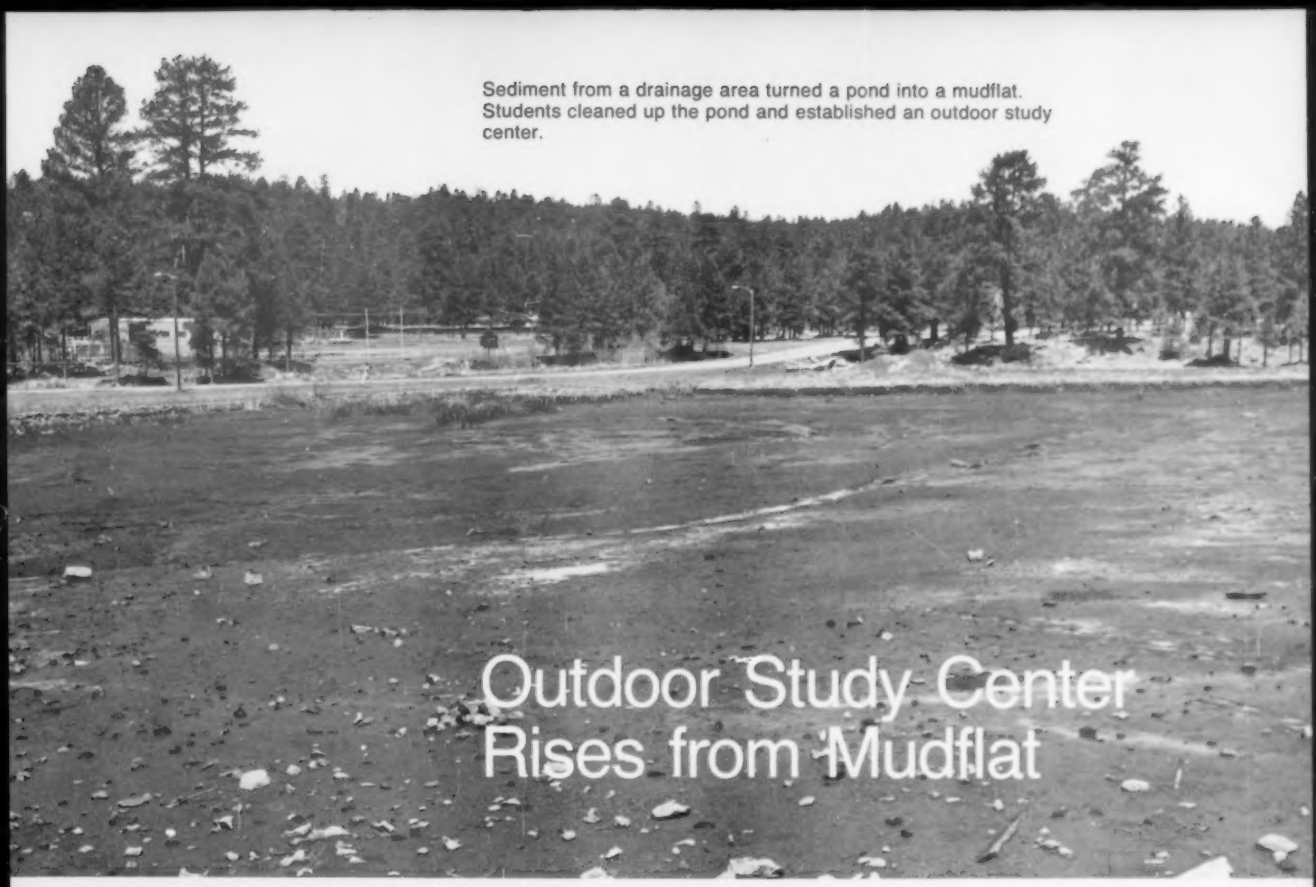
Mike Mellano said his drip system causes fewer salt problems than furrow irrigation. "Under furrow irrigation, capillary action pushed salt to the top of the beds. Concentrations built up, and the flowers did not stay at their peak as long. Our drip system has produced no salt buildup, and we are growing more, better quality flowers," he said.

In some areas, rodents and coyotes damage drip systems by chewing lateral lines. The use of polyvinyl chloride (PVC) and buried laterals has largely eliminated this problem, but not before at least one irrigator came up with his own ingenious solution.

Allan Chaikin was puzzling over the problem of coyote cubs teething on laterals in an avocado orchard when he noticed a mail-order ad for wild animal scents in the back of a magazine. Remembering that mountain lions are natural enemies of coyotes, he ordered several vials of cougar urine. Chaikin dipped cotton swabs into the urine and stapled them onto redwood stakes placed throughout the orchard. "Within days," he said, "the coyotes disappeared and never returned."

Although drip irrigation is not for every crop, soil, and farmer, it meets many farmers' special needs and offers great promise to agriculture where growing population and industry are increasing demands on a limited supply of vital resources—arable land and water.

Ms. Schuhart is a writer-editor, Information Division, SCS, Washington, D.C.

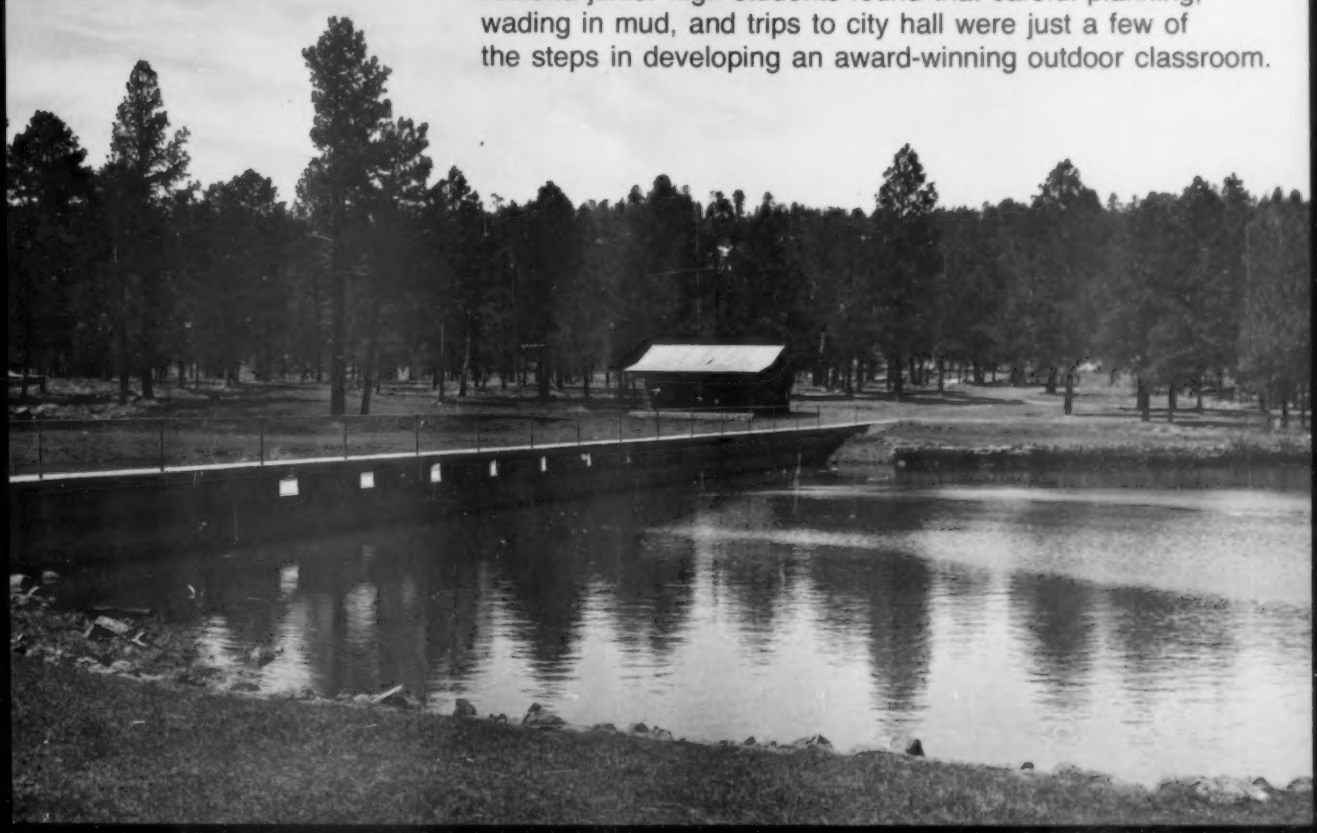


Sediment from a drainage area turned a pond into a mudflat. Students cleaned up the pond and established an outdoor study center.

Outdoor Study Center Rises from Mudflat

by James Alam

Arizona junior high students found that careful planning, wading in mud, and trips to city hall were just a few of the steps in developing an award-winning outdoor classroom.



Students, teachers, and the Youth Conservation Corps seed and plant the shoreline of the pond with selected grasses and legumes.

At the beginning of their cleanup campaign, students had to remove refuse from the pond, including tires and other auto parts.

During the early planning stages, an inventory was made of wildlife and other natural resources.

More than 50 years ago, the city of Flagstaff, Ariz., set aside 100 acres of land known as Thorpe Park. Today, that land is the site of a prize-winning outdoor classroom developed by students and faculty of Flagstaff Junior High School with help from parents and local resource agencies.

The 18.5 acres that make up the campus include a 3-acre pond built in 1923 below a small, city-funded dam on the Rio de Flag. The pond became the focus of a learning experience that took students beyond aquatic studies to meetings with city officials to discuss downstream flooding and traffic control on the school site.

The pond had provided seasonal swimming and ice skating for years, but sediment from the 55 square miles of drainage above the pond had turned the pond into an unsightly mudflat by the time the school was built in 1970.

"We had to drain the pond each year following the spring runoff, and recreational use of the area had become limited to a single campout each summer," noted Jim David, biology teacher and initiator of the outdoor study center. "The area had become a dump,

Students planted pine seedlings following a plan developed with SCS help.

Tires are used to build an artificial reef for aquatic insects and fish.

and plants and wildlife suffered because of extreme fluctuations in water levels."

David began a cleanup campaign on campus and encouraged some of his students to assist in a successful effort to clean up the pond area. The "I care" buttons still worn by students recall those days.

However, the battle at the pond was not so easily won. The remains of each summer's campout greeted the students upon their return every fall. One of David's former students noted that: "If it had not been for Mr. David's encouragement and enthusiasm, we would have been willing to ignore that mess and live with it. However, during the cleanup stages and when we ran into problems on the project later, Mr. David never gave up and challenged us to do the same."

The turning point for the project came during the 1974–75 school year. The cleanup work had gained the support of other teachers and administrators and a number of parents. Dick McCallum, a counselor at the school, mentioned David's work to Soil Conservation Service people during a discussion about some student conservation projects. The teachers and students, with help from SCS, began to collect ideas and to plan the use of the area.

As it turned out, developing a plan and seeking permission from city officials to create their "dream," transformed what had been a learning process about natural resources into a political science class. During the late spring of 1975, David and his students spent a lot of time at council and commission meetings trying to convince people of the value of their project.

Downstream flooding, traffic on Aztec Street, and access for emergency vehicles to nearby ball fields and to an adjacent subdivision were related issues that had to be resolved. Before school closed for the summer, however, the project won official approval and construction began during vacation. With help from the city, students started by removing refuse, including tires and other auto parts, that had accumulated in the mud.

USDA's Forest Service, under the Educational Act of 1970, provided heavy equipment to construct the wishbone-shaped island in the middle of the pond. This unusual shape, which will provide maximum "edge" habitat for wildlife, was submitted by Luke Ferguson as part of a class project to design the island. Following the completion of the island, students, teachers, and the Youth Conservation Corps seeded the island and shoreline with selected grasses and legumes according to plans developed by SCS. Three small, rock dams were built in the Rio de Flag drainage above the pond to help trap sediment and protect the pond area.

By the beginning of the 1975 school year, the pond was ready and students looked forward to expanding their efforts to the surrounding area. A boost to enthusiasm was provided when the Arizona Bicentennial Commission recognized the outdoor classroom as a Youth Bicentennial Project for the Flagstaff area. In addition to a $1,400 grant to support the work, the commission cited the program, noting that "education in wildlife management and outdoor learning centers are needed in every community. Outdoor learning

The pond is only a short walk from the school building; but when students are studying in the outdoor classroom, they no longer feel they are on the school grounds.

centers are a continuing program and will serve future students."

Equipment, seed, and construction materials were purchased using matching funds from the school district. During the year, aquatic animal life such as filament algae, one-celled organisms, rotifers, fairy shrimp, crayfish, frogs, bluegill, and largemouthed bass were stocked in the pond. A plant center was designated for experiments with different species for landscaping, erosion control, and wildlife habitat.

Although the entire campus, including the building and parking lots, is included in the conservation plan for the outdoor study center, the water and surrounding "natural" area take on special meaning.

"The pond is an extension of the school campus, but it is not on the schoolground and that's one reason it's important," said Cheryl Covington, a junior high teacher. "Although we can reach the natural area with a few minutes' walk from the school door, once we're at the pond our students no longer feel they are on the school grounds. There is something special about the area and the students treat it with consideration."

An "Outdoor Classroom Project Guidebook," developed by teachers and students, identifies plans for use of the area over the next decade.

Both teachers and students view the project with varied ideas of its benefits and potential. "Few teachers got involved in the early stages," according to teacher Carol Painter. "More and more became interested and involved as things began moving, and many are using the area now." The feeling has spread to nearby schools and to Northern Arizona University (NAU), which used the outdoor lab for several classes this past year.

David is working with NAU instructors to develop teaching guides for the outdoor classroom and to design a university-level summer course that would explore environmental education teaching methods.

Kam Marsh, one of several students who bus to school from Oak Creek, about 25 miles south of Flagstaff, says student enthusiasm for afterschool work on the pond convinced the school board to authorize an activity bus on pond workdays: "If you want something worthwhile and can present the facts properly, you often get what you're after."

"I never would have gotten up in front of a group of adults to speak if it hadn't been for the project," added David Nations, now a senior at Flagstaff High School and president of the student council. "Working on the outdoor study area did more to build school unity and support than anyone would have expected."

Luke Ferguson, who designed the wildlife island for the pond, today is a high school junior. It's his feeling that "we created something we know will be there in the future, something we can visit often and see the results of our efforts."

Mr. Alam is district conservationist, SCS, Flagstaff, Ariz.

by Ronald W. Gilkeson

Flood Water "Gets Right on Out" of Stumpy Bottom

In the West Virginia community that used to be plagued by flooding, stream improvements prevent flood damage and reduce health hazards.

Before residents were assisted by the Mountain-Dominion RC&D Area, they had perennial flooding problems with damage averaging more than $6,000 a year.

They call it "Stumpy Bottom," but up until 2 years ago, it was more soggy than stumpy. That was before a Resource Conservation and Development (RC&D) measure showed local residents how to handle stormwater.

This 47-acre community near Princeton, W. Va., was built on a low area filled with stumps. Most of the stumps were removed, but flooding remained a perennial problem. Runoff from a 170-acre watershed flooded the area regularly—often several times a year. The average price tag on flood damage was more than $6,000 a year.

"We had many floods," said resident R. L. Thomas, "and water would stand for days after a heavy rain."

Health hazards rose along with the floodwaters. Mosquitoes and rats were potential disease carriers. Sewage disposal was inadequate. The Mercer County Health Department finally banned further installation of septic tanks in the area.

Some of the more than 50 homeowners tried to minimize flood damage by installing small drains and culverts here and there. Their efforts had little effect.

So residents took their community's problems to the steering committee of the Mountain-Dominion RC&D Area. The committee, composed of local people concerned with the proper development and management of natural resources, asked the Soil Conservation Service to explore possible solutions.

That was the beginning of an effort that ultimately involved several agencies, and many local people.

SCS recommended improving one stream to carry away the storm runoff and installing a ditch to remove standing surface water. The West Virginia Department of Highways agreed to install culverts under a road to provide an adequate outlet for the water to flow into an existing stream. The Mercer County Commission acquired land rights and joined with the Southern Soil Conservation District in sponsoring the measure.

The improvements were completed in the spring of 1975 at a cost of $10,972 in RC&D funds. The county commission maintains the improvements.

Homeowners and businessmen now enjoy the measure's benefits. "When it rains now," Thomas said, "the water gets right on out of the bottom. It's a grand thing!" An industry that recently located in the area also found the measure to be a big help in site preparation. Stoner Parsons, the company's owner, believes that it "will help for years to come."

C. B. Yearout, a cochairman of the Mountain-Dominion RC&D steering committee, feels that the measure's results have demonstrated for people in the community that "much can be accomplished when government agencies and local citizens work together toward a common goal."

Mr. Gilkeson is RC&D coordinator, Mountain-Dominion RC&D Area, SCS, Princeton, W. Va.

Good range management on Federal resource lands in Wyoming helps nearly 20,000 Teton elk survive the harsh winters.

by R. Steve Scheldt

Elk Country

Without supplemental feeding, range management, and conservation practices, elk herds in Wyoming would be decimated or even extinct.

Jackson Hole in western Wyoming has been elk country as long as anyone can remember. In the vast wilderness, the call of the bull elk is as much a part of fall as the shimmering gold aspen, skiffs of ice on streambanks, and a fresh mantle of snow on the majestic Tetons.

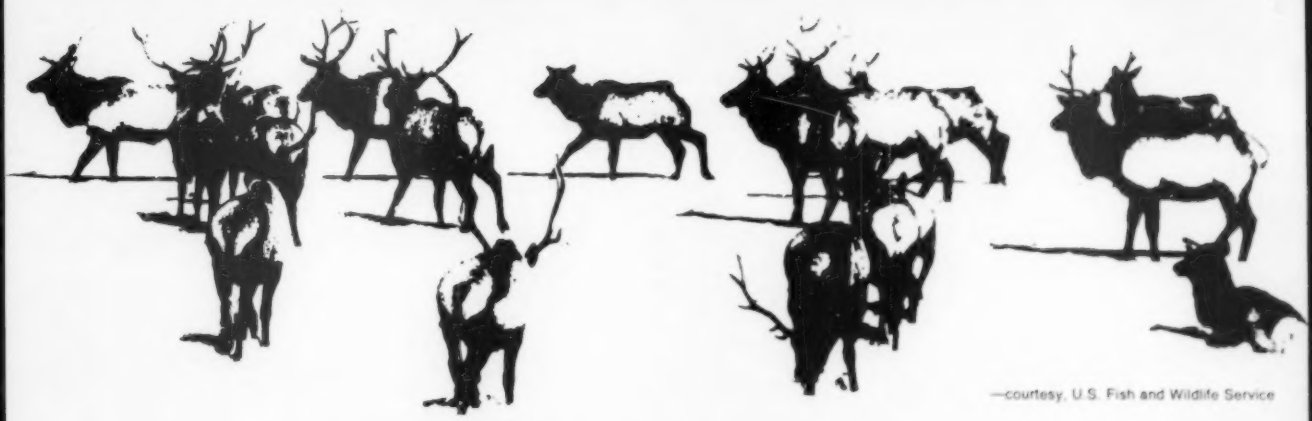
But without the intervention of government agencies and other conservation groups, the Teton elk herd would be decimated or maybe even extinct.

In the early 1900's the Federal Government began its effort to preserve the elk's natural habitat around Jackson Hole. Since about 1957, the Soil Conservation Service has been working with local and other Federal agencies to conserve and manage the land mainly for elk.

The elk herd at Jackson Hole is one of the two largest herds of native elk in North America. Its habitat includes most of Teton County, all of the Teton National Forest, and part of the Bridger and Targhee National Forests. The heart of the summer range covers Grand Teton National Park and much of the southern part of Yellowstone National Park.

Historically, the elk migrated to winter ranges in valleys along drainageways of the Snake River, including Flat Creek, Buffalo Fork, Spread Creek, and the Gros Ventre River. Even after a severe storm in November 1896, residents of Jackson estimated 20,000 elk at Flat Creek. But during the severe winters of 1909 and 1911, thousands of elk starved.

In an effort to provide food for the elk in winter, Congress appropriated $50,000 to buy land to raise hay for



—courtesy, U.S. Fish and Wildlife Service

the animals. In 1913, 1,760 acres were bought with the money, and in that same year, 1,040 acres of public land were added by Presidential Order. This land was used for the National Elk Refuge which was established for the preservation of the elk wintering in Jackson Hole. The Izaak Walton League of America donated an additional 1,760 acres to the refuge in 1927, and through the 1950's more land was purchased as it became available.

Today, the refuge covers 24,000 acres and is managed entirely as wildlife habitat. Although it was established mainly for elk, the refuge also benefits other wildlife. Mule deer, bighorn sheep, and coyotes live on the refuge, and a small resident flock of rare trumpeter swans winters there.

With the establishment of the National Elk Refuge, the U.S. Biological Survey and its successor, the U.S. Fish and Wildlife Service, began feeding operations. Each winter since 1912, except during 7 years of light snowfall and mild weather, elk have been fed on the refuge.

The present elk population wintering in areas drained by the upper Snake River and its tributaries numbers about 20,000 even though some of the former winter range has been taken for agriculture and other development. Of these, about 8,000 elk winter on the National Elk Refuge, and about 8,000 winter at nine smaller feedgrounds operated by the Wyoming Game and Fish Department. The rest range free on other Federal land.

The National Elk Refuge may sound like simply a feeding ground or elk welfare program, but present objectives are to manage the elk winter range to provide only supplemental feed. No hay has been harvested since 1966, and all forage is left standing for elk to use on a free-ranging basis.

The Fish and Wildlife Service entered into an agreement with the Teton County Conservation District in September 1957. Through the district and Soil Conservation Service, many conservation practices have been planned and implemented to enhance the wildlife habitat. Soil surveys and wildlife land resource inventories have been completed, and thousands of feet of irrigation ditches have been installed. More than 2,000 acres in the refuge are irrigated.

Clipping data show that under irrigation Russian wildrye produces approximately 1,400 pounds per acre, and smooth brome and alfalfa produce 2,000 pounds. Elk showed a preference for wildrye on the refuge, using 75 percent of the annual production, compared to 40 percent of the smooth brome and alfalfa. Besides being more palatable, wildrye remains upright after curing and under normal snow cover.

One problem for refuge managers has been holding elk on the north end of the refuge where sagebrush and grass intermingled with stands of aspen produce a large amount of native forage. In the past, once the elk were on the refuge, they migrated to the subirrigated meadows and irrigated pastures at the south end.

Because fencing is not a reasonable alternative, other methods are being used to establish a pattern of use at the north end. To improve forage quality and quantity, sagebrush has been controlled on some of the area by tilling, railing, chopping, trampling, and prescribed burning. And some areas have been reseeded with wildrye to make the area more attractive to elk.

Prescribed burning appears to help control sagebrush and in some areas has increased grass production by as much as six times. In some decadent aspen stands, fire appears to stimulate suckering, resulting in successful regeneration.

Small stacks of hay, strategically placed, also have helped hold elk at the north end. Forage utilization is highly dependent on animal distribution. Feeding elk alfalfa pellets in a line leading toward the area to be grazed has proved to be successful in moving elk from one area to another. Once the animals are there, pellets can be used to hold them in the area. Elk can be moved several miles a day by this method.

Federal and State agencies must cooperate to insure the existence of the elk. The Fish and Wildlife Service, National Park Service, Forest Service, Wyoming Game and Fish Department, Wyoming Outfitters Association, Soil Conservation Service, and many other groups and individuals have a part in making the complex management decisions that control the future of possibly the largest elk herd in the world.

Mr. Scheldt is a wildlife biologist, SCS, Grand Junction, Colo.

A Profile of Our Soil and Water Resources

by Nadine E. Pitts

Data are being collected to determine the condition of our Nation's soil and water resources. During the first stage of the study, the most common types of erosion will be evaluated.

A variety of questions about land and water quality will be answered by a national study of soil erosion.

A decade ago the most comprehensive conservation needs inventory ever undertaken showed that erosion was the dominant conservation problem on about half of the Nation's privately owned rural land.

How much of a problem is soil erosion today? How much land continues to be damaged by wind and water, and how much topsoil ends up as sediment polluting our rivers, lakes, and streams?

The Soil Conservation Service has embarked on a two-stage national erosion inventory to answer these questions and to update the 1967 National Inventory of Soil and Water Conservation Needs. The survey will evaluate soil and water conservation needs, prime farmland, potential cropland, water quality, wetlands, and land use.

When the inventory is completed in 1979, the Nation will have an up-to-date profile of its soil and water resources and their condition.

Iowa State University (ISU) Statistical Laboratory helped design the study. It also will help analyze the complex data, using computer techniques.

The inventory is more comprehensive than the one made in 1967, which included only nonfederal, rural lands. The new study includes all nonfederal lands, Federal lands leased to private operators, and National Forest System lands. All Federal land management agencies have been invited to participate in the study.

Data are being gathered by SCS personnel at 72,500 sites in 49 States (all but Alaska), Puerto Rico, and the Virgin Islands. USDA's Forest Service is assisting SCS in field evaluations of sample sites on private forested lands, and will collect data on National Forest System lands.

Sample sites range in size from 40 to 640 acres, and were selected at ISU's Statistical Laboratory by random sample methods. Half the sites used in the 1967 inventory are represented in the new study, which will allow comparisons between conditions then and now in those areas.

The most common types of erosion—sheet, rill, and wind—are being studied during the first stage of the study. Gully, streambank, roadside, and construction site erosion will be inventoried during the second stage.

By mid-1979, SCS will be able to calculate estimated sediment yields from all types of erosion. The inventory also will supply information useful in other current research. USDA's Economic Research Service plans to use inventory data in its study of social and economic factors relating to soil erosion.

Ms. Pitts is a writer-editor, Information Division, SCS, Washington, D.C.

News Briefs

Flood Prevention on the Washita

Flood protection efforts on tributaries of Oklahoma's Washita River prevented $20 million damage during two storms last spring, according to a Soil Conservation Service study.

Although the storms caused several million dollars of flood damage, additional losses were averted by about 1,000 structures that have a combined floodwater capacity estimated at 195 billion gallons. The land treatment practices above the structures also helped control the flooding.

Significant flooding occurred in four subwatersheds of the Washita River, while the retarding structures safely contained potential floodwaters in 60 subwatersheds. The May 1977 storms averaged nearly 4½ inches of rainfall throughout the Washita Basin during a 2-day period, followed by about the same amount of rain over a large section of the watershed during 1 day less than a week later.

The 1,000 floodwater retarding structures cost about $80 million.

Aerial Seeding in New Hampshire

In fall 1976, 17 farmers participated in an aerial seeding program in Grafton County, N.H., where some farms are losing 15 to 18 tons of soil per acre each year. Winter rye was planted from the air before the corn was harvested. Within 2 weeks, the cover crop had grown 2 to 3 inches. The Agricultural Stabilization and Conservation Service shared 50 percent of the cost with the farmers. The seeding resulted in an estimated 3 tons per acre of organic matter which was plowed back into the soil last spring.

Meetings:

October	
2–6	Congress for Recreation and Parks, Las Vegas, Nev.
2–6	National Association of County Agricultural Agents, Hartford, Conn.
2–7	Water Pollution Control Federation Conference, Philadelphia, Pa.
8–12	American Institute of Planners Conference, Kansas City, Mo.
14–20	National Environmental Sanitation and Maintenance Educational Conference, Exposition, Lake Buena Vista, Fla.
15–19	American Bankers Association, Houston, Tex.
16–19	American Forestry Association, Monterey, Calif.
20–23	National Association of Biology Teachers, Inc., Anaheim, Calif.
25–29	American Horticultural Society Conference, Pasadena, Calif.
27–28	American Association for Vocational Instructional Material, Fargo, N. Dak.
29–Nov. 2	Adult Continuing Education National Conference, Detroit, Mich.
31–Nov. 2	American Association of State Highway and Transportation Officials, Atlantic City, N.J.
November	
6–9	Irrigation Association, New Orleans, La.
7–9	Geological Society of America, Seattle, Wash.
8–11	Future Farmers of America, Kansas City, Mo.
13–16	National Forest Products Association, San Diego, Calif.
13–17	American Institute of Chemical Engineers, New York, N.Y.
13–18	Soil Science Society of America, Los Angeles, Calif.
14–22	The National Grange, Greensboro, N.C.
15–16	Purdue Air Quality Conference and Exhibition, Indianapolis, Ind.
22–26	National Council for Geographic Education, St. Louis, Mo.
29–Dec. 1	Western Forestry and Conservation Association Conference, Seattle, Wash.
30–Dec. 2	Keep America Beautiful, Inc., National Meeting, New York, N.Y.
December	
4–6	American Society of Farm Managers and Rural Appraisers, Inc., Denver, Colo.
5–9	American Geophysical Union, San Francisco, Calif.
12–13	American Society of Agricultural Engineers, Erosion and Sedimentation Symposium, Chicago, Ill.

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